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Assessing the Future:

A Sensitivity Analysis of Highway and Road Improvements on Growth in the San Francisco Bay Area

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ASSESSING THE FUTURE:
A SENSITIVITY ANALYSIS OF HIGHWAY AND ROAD IMPROVEMENTS ON GROWTH IN THE SAN FRANCISCO BAY AREA

PREPARED FOR THE METROPOLITAN TRANSPORTATION COMMISSION

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OVERVIEW

This study was requested by the Metropolitan Transportation Commission (MTC). MTC asked ABAG to analyze the impact of the 1989 Transportation Improvement Program (TIP) of the agency on the distribution of growth in the Bay Area. Two scenarios were developed to complete this task: "build" and "no build." The "build" scenario contains the proposed highway TIP developed in 1989. The "no build" scenario assumes the 1990 highway network. The year 2010 was chosen as the target year for the analysis, since it is assumed all of the 1989 identified projects would be completed by that time. In addition to the two scenarios, two tests of the impact of these scenarios were developed. **Test 1** uses existing land use policies and ABAG's **Projections 90** as the basis for the analysis of the travel time network on growth distribution. **Test 2** also looks at the impacts of the transportation network scenarios on growth distribution but **relaxes local development policies as a constraint in the model.** There are two objectives of Test 2. These are: (a) assess ABAG's POLIS model's sensitivity to travel time changes in an **unconstrained land use** simulation, and (b) identify whether the "build" or "no build" scenarios affect urban sprawl within the Bay Area.

INTRODUCTION

Before beginning the sensitivity analysis, an overview of the ABAG modelling system will provide an understanding of the process used to do the economic and demographic forecasts in the Bay Area. The system has its origins in the year 1981 and has evolved over this period. Updates and recalibration of most system elements occurs every two years. The system is a "top-down bottoms-up" modelling system. That is, the final results reflect not only the results of model outputs, but also reflect comments from users, in particular, local government planning staffs.

In addition to outlining the modelling system at ABAG, MTC requested that ABAG undertake an analysis of two transportation scenarios. These scenarios, "build and no build," reflect potential future transportation networks in the Bay Area. The "no build" scenario is the 1990 transit and highway network in the Bay Area. The "build" scenario is found in the MTC TIP document, issued September 18,1989 by MTC for the nine-county Bay Area. This reflects the proposed improvements to the roadway network in the Bay Area. MTC gave ABAG two travel matrices, developed by Ron West, reflecting total travel time under each scenario keyed to the 114 zonal system used by ABAG to distribute jobs and households in the Bay Area. The objective of this sensitivity analysis is to assess the impact of these two travel time networks on the distribution of jobs and households in the Bay Area.

DESCRIPTION OF THE ABAG MODELLING SYSTEM

The existing ABAG modelling system had its origins in 1981. This system replaced the previous modelling system at ABAG that evolved in the 1970s. There were two primary models replaced during this period. The first, BEMOD (Basic Employment Model), was a projected model partly based upon shift-share analysis and statistical projection.

The second model, PLUM (Projective Land Use Model), was a Lowry type allocation model that used land and locational factors to sequentially allocate jobs and households throughout the region. The primary reason for upgrading and replacing these models was that they were viewed as not being sufficiently dynamic in modelling the actual interactions in the economy and population.

The **existing** modelling system should be viewed at the macro level as a system designed to model the supply-demand interaction of economic, demographic, resource, land use factors and policy instruments affecting this regions development. The system is viewed as a "top-down bottom-up" modelling network and is tiered. That is, the first tiered model that drives the changes in the region is the RIS (Regional Information System) model. Documentation for the original model exists, and the model was published in the **Annals of Regional Science,** Vol. XVII, November 1983 under the title, "The Design and Implementation of a Regional Economic-Demographic Simulation Model."

Regional Information System

The Regional Information System (RIS) is driven by models that forecast the changing economic structure of the Bay Area economy. The core of the system is an interactive regional input-output model that is updated every three years. The model interacts with population, labor force, energy and migration models. It forecasts on an annual basis. The population model is a cohort survival model. The economic model drives the demand for labor which interacts with the population model. Migration is a function of both economic and non-economic factors in the model. In the past, ABAG has used long-term population forecasts from the California Department of Finance (DOF) as a comparison against the ABAG population forecasts. Unfortunately, the long-term DOF data is not updated frequently (latest update is December 1986), and as of 1987, ABAG discontinued use of this information. When the data becomes more current, long-term DOF population estimates will again be used as a bench-mark of the ABAG long-term population forecasts.

The RIS model produces regional job, income, population and labor force data. That information is used to establish the **initial condition** for the next tier of models.

County Level Forecasts

Two primary models are used to forecast change at the county level. The first model, **CEFS (County Employment Forecast System),** is a statistical time series model, using linear regression. Regional and county employment data, as well as employment trends internal to the county, are used to forecast future economic activity in a county. The model is documented in the **Annals of Regional Science**, Vol XIX, July 1985. The article's title is "Industrial and Spatial Interdependency in modeling: An Employment Forecasting Model for the Counties in the San Francisco Bay Region." The models statistical time series covers the period 1964-1988 and is updated annually. The series is used as the basis to develop prediction equations. The equations are updated every two years. **CEFS** is linked to regional jobs numbers and is used to predict future job growth and income growth by county.

Employment forecasts are evaluated by county and sector to insure that changes in trends do not affect the forecast. This "hands-on" process in forecasting is essential. It permits professional judgement to enter the model, since the data only picks up changes in trends "after the fact."

Population by county is projected by using several different statistical techniques. The data for this series comes from DOF annual population estimates for January 1 of each year. The present series extends from 1975 to 1990. This data is used to develop linear, exponential, geometric and, in selected cases, n^{th} order equations that are used to predict trends of the interaction between time and population change. Time is the independent variable in these models. After these simple statistical techniques are used, a composite of all the trend methods is developed. This is used to represent trends of county population growth.

The above data is evaluated in light of local development policies. That is, staff does not assume historical trends will continue. For example, the trend of household growth indicates that Santa Clara County would add about 157,000 households between 1990 and 2005. Post-1985 **existing** development potential indicates that policies would permit expansion to about 126,000. ABAG estimates that the potential will increase above the existing local potential to about 130,000 over the period, but not anywhere near the 157,000 as suggested in the trend analysis. Therefore, long-term future growth in households is heavily affected by **existing** development policies. This supply-demand interaction is translated into impacts on population and household size. The impact of housing supply constraints is less dramatic on population growth because of the shifting structure of household size. This shift is attributed to the changing ethnic and cultural structure of the region's population.

The critical point is that at the county level, interaction between local development policies and the trend or forecast can be measured by the models. The development policy information is used to alter the trends. But the forecast **does not represent the local development policies in specific. They only represent the general direction of the growth.**

That is, development policies determine the direction of growth, not necessarily the level of growth. After the final preliminary estimates of population, households and household size are calculated, they are sent to each county planning department for review and comment.

At this stage, county level employment, population, households and employed residents are available for use in the **POLIS** optimizing location model.

POLIS (PROJECTIVE OPTIMIZATION LAND use INFORMATION SYSTEM)

POLIS was originally developed by Dr. Poulicos Prastacos during his tenure as Senior Regional Analyst at ABAG. ABAG has used POLIS since 1983 as the allocation model for sub-county distribution of jobs, households, population and labor supply. The system is structured around 114 zones. Each zone consists of Census Tracts. The 114 zones cover the nine-counties in the Bay Area. Documentation is available, and the model structure, estimation and original calibration is published in **Environment and Planning.** The first article, "An Integrated Land-Use Transportation Model for the San Francisco Region: 1. Design and Mathematical Structure," appears on pages 307-322 in the journal. The second article on empirical estimation and results appears on pages 511-528 in volume 18 of the journal. The model has several functions. These are:

a) simulate the interaction between jobs, housing and regional transportation system and provide a consistent description of the future pattern of development;

b) model future policy impacts by undertaking sensitivity analysis on the provision of housing, location of development projects and construction of new transportation facilities;

c) simulate economic behavior based upon utility maximization,

d) and finally, model local planning and zoning constraints to realistically produce forecasts that reflect actual development futures.

The model is a land-use transportation model which allocates urban activity functions identified above, and creates commute flow tables. The model is based upon microeconomic behavior principles, formulated as a mathematical programming problem which integrates and solves simultaneously for a solution. There are two primary components of the model: a linear program (LP) which seeks to maximize utility and minimize opportunity costs associated with a location and a gravity model matrix that assigns trips to zones based upon minimum travel time between zone. The gravity model uses household and job forecasts from the linear program by year and zone as control totals to generate a trip distribution matrix. The Metropolitan Transportation Commission provides ABAG with a travel time matrix. This matrix reflects the latest TIP. The column and rows are summed in the trip distribution matrix and the result is the total time required in the solution.

These rows and columns, as well as the travel time sum becomes a new constraint in the LP by use of the Bender's cut. For computational efficiency, the dual of the primal LP is used to solve the problem. The LP and the gravity model interact until the model converges at a fixed level. This solution is a distribution of jobs, households and labor that minimizes the opportunity cost associated with a specific location subject to the policy and economic constraints estimated or forecast for each time period. Conversely, the solution maximizes total regional consumer utility.

SAM (SUBAREA PROJECTION MODEL)

SAM is the final model that allocates growth to the Census Tract. SAM allocates employment, households, population and labor force based upon land availability and density assumptions. Data for this model comes from the zones found in POLIS. Each zone in POLIS consists of Census Tracts. Output of each zone (which consist of a series of Census Tracts) in POLIS is used as a control total for SAM allocation to each Census Tracts within the zone. In addition to using data from POLIS, SAM also has a statistical routine that forecasts household income by Census Tract. County household income data is derived from RIS, CEFS and independent estimates.

Therefore, SAM is the model which estimates small area growth based upon land use data, density information and the previous level of growth in a Census Tract.

REVIEW AND LOCAL REVIEW

Forecast data is reviewed at the Census Tract, city and sphere-of-influence levels for reasonableness and consistency with local development policies. As noted earlier, staff closely follows short-term development policies of each jurisdiction within the forecasts. Over the long-term (post-2000), staff makes judgements, by jurisdiction, as to where policies might change. Staff does not always assume policies will change to accommodate growth. This feedback, as noted earlier, affects population, labor force and potentially job growth at the regional level over the long-term. After ABAG has completed the internal review of the forecasts by tract and sphere-of-influence or development area, the forecasts are sent to city and county planning departments for local review. The review period lasts six weeks. During this period, staff accepts comments for revision. Local governments review population, households, employed residents and job forecasts for their jurisdiction. Staff produces a document which covers comments from each community in the Bay Area.

To summarize, the ABAG forecasting system is a "top-down bottom-up" process. The forecast is for a single point in the future, although other scenarios are possible. The problem with scenarios is that one must be chosen for planning purposes. Therefore, the tendency is to select the forecast most consistent with the plans and policies of the local government. Hence, ABAG's forecast reflect the "most likely" future. This does not mean that this future will not or cannot be changed. In fact, this process of updating the projections--which occurs every two years--permits substantial changes.

SENSITIVITY ANALYSIS OF MTC'S "BUILD AND NO-BUILD" TRAVEL TIME SCENARIOS

The Metropolitan Transportation Commission (MTC) requested that ABAG perform a sensitivity analysis of the impacts of two travel time scenarios on the distribution of growth within the Bay Area. These two scenarios are:

> A) "Build" Scenario- This scenario reflects the expected travel time between origins and destinations at the completion of the highway and road improvements in the year 2010. The projects proposed are in the MTC Transportation Improvement Program as of September 18, 1989.
>
> B) "No Build" Scenario- This scenario reflects the travel time expected in the year 2010 given the 1990 transportation network. It assumes no improvement in the existing highway network.

ASSUMPTIONS AND INITIAL DATA NEEDS

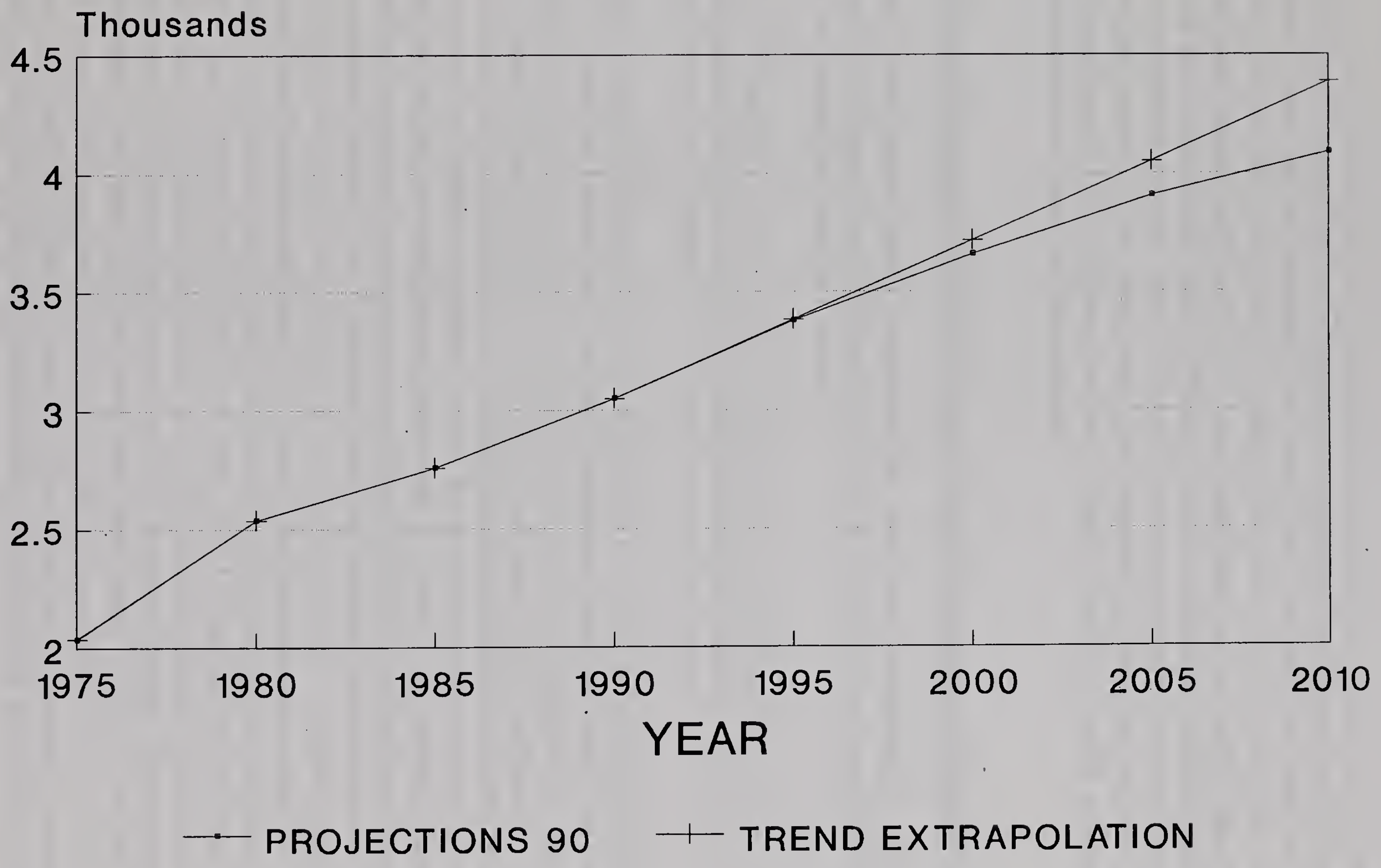
In this analysis, ABAG used its spatial allocation model (POLIS) to test the sensitivity of travel time changes on the distribution of jobs and households in the nine-county Bay Area. In determining the level of growth that would be used in the simulation, ABAG used data it had developed for the year 2010 for **both scenarios.** Two travel time files were delivered to ABAG which had origin and destination time data at the 114 zonal level used by POLIS. The data from MTC was representative time for the identified zones.

A. What does the level of growth forecast for 2010 show for the Bay Area?

Table 1, **Long-Term Job Growth: Trends vs. Forecasts**, compares the latest ABAG long-term job growth forecast to the year 2010 with that of a forecast of trend. The trend is projected using linear regression from employment data covering the period 1975-1990. The table shows a forecast of slowing job growth into the future, with almost 300,000 fewer jobs than the trend would indicate. Why the slow-down? The slowdown in job growth is not a recent phenomenon. Relative to the 1970s, Bay Area job growth decreased substantially in the 1980s. Overall, the economy and region is beginning to experience the early stages of a maturing economy. This process will have some impact on the distribution of growth and the level of growth in the Bay Area. The key is that ABAG's forecasts are not simply based upon past trends. The overall numbers used to determine the sensitivity of the "build and no-build" travel network in the Bay Area came from the ABAG document PROJECTIONS 90, and subsequent updates.

Table 1: LONG TERM JOB GROWTH

TRENDS VS. FORECAST



SOURCE: ABAG; EDD

Sensitivity Analysis

There were two tests undertaken to determine the sensitivity of the travel time data provided by MTC on the distribution of jobs and households in the Bay Area. The base year for both tests was 1990 and the terminal year was 2010. The base year data is ABAG's estimate of jobs and households in the Bay Area, aggregated by POLIS analysis zones. In **Test 1,** local development policies by zone were maintained in the model. The objective of this test was to ascertain **how much influence local development policies had on the distribution of growth in the Bay Area.** In **Test 2,** the development policy constraints were removed from the model at the zonal level. The objective of this test was to ascertain **whether the improvement in the highway network ("build" scenario) would accelerate the spatial decentralization of jobs and households.**

Test 1: Analysis of "Build and No Build" Scenario Using Development Policy Constraints

In this scenario, development policy constraints by zone were maintained in the POLIS MODEL. That is, the upper bound of growth or change in growth was assumed to be the development policies of the local jurisdiction.

The objective of the scenario was to assess the impact of each travel time matrix from MTC, given the development policy constraints on each zone. Since POLIS is set-up as a LP each zone is defined by a set of constraints that affect the solution space.

Of the 114 zones in the POLIS system, six (6) zones had a change in household distribution and thirteen (13) zones had a change in the job distribution, given the "build" and "no build" scenarios incorporated into the model. Hence, in the case of households, a little over 5 percent of the zones in the region were affected; in the case of job distribution, about 11 percent of the zones were affected. **In terms of total households impacted by the "build" and "no build" scenario only 5,400 households shifted from one zone or another. This is less than 1 percent of the total households expected in the Bay Area in the year 2010. In terms of jobs affected by the alternative scenarios, only about 1,600 jobs shifted from one zone to another, also representing less than 1 percent of the total regional jobs expected in the year 2010.** The changes occurred in two counties: Santa Clara and San Francisco counties. The zonal changes in San Francisco and Santa Clara were contiguous to each other. In the case of San Francisco, the zones most impacted were zone 3 (SF-Northeast) and zone 9 (SF-Mission). In the case of Santa Clara, they were zone 48 (SJ-Edendale-North), zone 50 (SJ-Almaden) and zone 51 (Morgan Hill). The **"no build" scenario** shifted households in San Francisco from zone 3 (SF-Northeast) to zone 9 (SF- South of Market). **The shifts point to nothing significant.** The actual shift in households were under 1700 or less than half a percent of the households expected in the county by the year 2010. In the case of Santa Clara, the total shift in households was about 3700 or less than 1 percent of the expected households in the year 2010. The **"build" scenario** shifted households from the Morgan Hill zone to the SJ-Almaden and Edenvale-North zones.

It appears that improved access permitted these zones to develop out to their development potential. However, realistically, the zones are contiguous, and the assign of cause and effect is clearly not strong. The job shifts in the **"build" vs. "no build" scenarios** occurred almost entirely in Santa Clara County. The **"build" scenario** tended to shift jobs from west to east in the county. There were shifts elsewhere in the region, but the order of magnitude between zones was less than 100 jobs. In Santa Clara, the Palo Alto (zone 27), the Cupertino (zone 30) and the Santa Clara (zone 33) zones lost jobs. The Mountain View (zone 29) and the Milpitas West (zone 40) gained employment. Seventy-eight percent of shift went to the Milpitas zone which is affected substantially by the 880 network. The total shifts, however, in a regional context account for less than 1 percent of the jobs expected in 2010.

DID THE SHIFTS HAVE ANY STATISTICAL SIGNIFICANCE ?

A **Two-Way Analysis of Variance** (ANOVA) was run on both household and job changes. By observation, it is clear that there was no significant regional impact as a result of the "build" and "no build" travel matrices. However, an ANOVA test was applied to the data to see if the zones affected were statistically different **as a result of the two scenarios.** The analysis found that **statistically the sum of the zones impacted by the "build" or the "no build" travel time matrices were not different in either scenario.** In short, the network changes had little or no effect on the distribution of households and jobs in both the region and the affected zones within the **context of these scenario.**

Emphasis is added because it will be shown later that relaxing land use constraints has a substantial impact on the distribution of jobs and households.

TEST 2: Analysis of the "Build" and "No Build" Scenarios With Relaxed Land Use Constraints

In this test, land use constraints at the zonal level are relaxed. That is, local development policies no longer constrain the distribution of growth. The primary objective is to observe the impact of this relaxing of development policy constraints on the distribution of jobs and households in the Bay Area. This scenario permits POLIS to simulate the **maximum impact** of each of the two scenarios on the distribution of jobs and households. It allows a comparison of the results of TEST 2 with TEST 1, reflecting two different pictures of what the future would look like with and without existing **local development policies** within the transporation corridors of the Bay Area.

The number of zones affected in this test substantially increased. Twenty four zones showed sensitivity to the "build" and "no build" scenarios or 21 percent, in terms of redistribution of households in the region. In terms of job redistributional effects, the impact was substantially greater than the household effect. That is, eight-six zones were affected. Of this total, thirty-seven would be defined as substantial changes. That is, job changes of more than one-thousand workers.

Detail Discussion of Relaxing Land Use Constraints on Household Locational Decisions

There was no consistent distributional pattern over the region in terms of changes in the location of households within the transportation corridors. A county-by-county and corridor-by-corridor analysis which follows outlines the changes that have occurred.

Alameda-Contra Costa Counties; I-80;I-880 and I-680 Impacts

The impact of the "build" and "no build" scenarios was substantial in reallocation of households in these counties and corridors. **Note: the word substantial does not necessarily imply statistically significant.**

The model suggests that land use policies have been the primary **cause** of the decentralizing development pattern in this part of the Bay Area. Table 2 illustrates this point. The table is organized by corridor to dramatize the impact of relaxing land use constraints on the distribution of households within Alameda and Contra Costa counties. The results also show the sensitivity of POLIS to travel time. In this scenario, travel time and the attractiveness of each zone are the primary factors affecting locational decision-making. Given that land use policies no longer play a role, households tend to cluster closer to the Eastshore Bay communities. The greatest change is in the Brentwood zone (zone 94) of the HWY-4 Corridor. The HWY-4 Corridor is chosen because of the concentration of most of the East Bay's affordable housing. The Brentwood zone is furthest from the Bayshore communities. Simulating with relaxed land use policies in Alameda and Contra Costa counties resulted in a decline in the Brentwood zone's household growth from 37,600 households to about 11,600 households for both the "build" and "no build" scenarios. ABAG's latest forecast **(PROJECTIONS 90)** suggests that 37,600 households will be in the Brentwood zone by 2010. This suggest that Brentwood's demand for housing would decline dramatically, if local policies would provide more housing in other parts of the East Bay area.

Table 2
IMPACT OF LAND USE CONSTRAINTS ON THE DISTRIBUTION OF HOUSEHOLDS IN ALAMEDA AND CONTRA COSTA COUNTIES
2010

Corridor	Land Use Constrained	No Land Use Constraint
I-80	198,900	223,300
HWY-4	109,000	100,800
I-680	267,300	226,000
I-880	398,700	457,300
Total	973,900	1,007,400

Source: ABAG

Statistical Analysis

A two-way analysis of variance (ANOVA) was performed on Table 2 to determine if the difference between the constrained and unconstrained household allocation was statistical different. The analysis indicated that the difference between zones **was statistically significant.** The F-value was 39.29334 at 3 degrees of freedom. The P value is 0.0065876. Land use policies significantly affected the decision of households to locate among zones.

A. Detailed Analysis of "Build" and "No Build" Scenarios Within East Bay Corridors

Previous discussion focused upon the impact, in general, of land use policies on the locational decisions of households in the defined corridors. The travel time matrix used in the POLIS model was that for **PROJECTIONS 90.** This section will more closely focus on the "build" and "no-build" travel time scenarios, and their impact on locational decisions, independent of land use policies.

A. I-80 Corridor

The most significant change in this corridor between the "Build" and "No-Build" scenarios is an increase in the households locating in zone 80 (San Pablo zone) and a decrease in zone 87 (Walnut Creek zone). The San Pablo zone covers the City of San Pablo, part of the City of Richmond and El Sobrante. The "build" scenario increased households in this zone from 34,600 in the "no-build" scenario to 49,700. Both the "build" and "no build" scenarios in the **unconstrained simulation** exceeded the ABAG forecast for the zone in the year 2010. This indicates that locational preference exists in this zone, given available housing. The Walnut Creek zone went from 49,900 in the "no-build" scenario to 34,800 in the "build"scenario. Recall that **implicit** in the POLIS simulation, in this case, is that the only factor affecting location is **travel time.** The analysis, therefore, suggests that a **"build" scenario** in this **specific case** would result in **less urban sprawl, if land use policies permitted greater housing potential in this zone**. This is significant because in **PROJECTIONS 90**, the household forecast for the year 2010 for the San Pablo zone was 16,800. In the Walnut Creek zone, the 2010 household forecast was 35,800. This number is quite close to the 34,800 allocated by POLIS in the "build" scenario.

B. I-880 Corridor

The most significant shift in this corridor occurred between east and west in Alameda County. The "no-build" scenario allocates 21,700 households to the Dublin zone (zone 77). The "build" scenario allocates only 7,600 households to the zone. Two zones capture this shift in the I-880 Corridor. Zone 71 (Union City-East) and zone 73 (Fremont Baylands). Why the shift? In this simulation, households are telling us that they would seek locations close to work, if given the option. This would be an expected outcome and shows the model is correctly predicting consumer behavior.

The majority of the employment centers remain focused in the region's core. However, these centers have weakened in the 1980s. This weakening is partly the result of lack of accessability. This is one of the most direct examples of the impact of the "build" scenario. At least in the case of this corridor, the "build" scenario **reduces the economic incentives to sprawl** because it increases accessability to the economic centers in the region's core. It will also probably **increase the pressure to produce more housing in the Eastshore communities.** This solution (the "build" scenario) is the **most environmentally sound,** in terms of reducing auto usage because the fixed rail and bus network is most developed in this corridor.

More significant than the "build" and "no build" scenarios is the difference between the unconstrained housing potential simulation and those of **PROJECTIONS 90** reflecting a growth distribution influenced by local housing policies. ABAG forecasts, in PROJECTIONS 90, ABAG forecasts 93,000 households in zone 77 (Dublin), zone 78 (Pleasanton) and zone 79 (Livermore). This is identified as the **constrained** simulation. In the "build" and "no build" scenarios, called the **unconstrained** simulation, 48,300 households are allocated to these in the "build" scenario and 62,300 households are allocated in the "no build" scenario. This example is presented to illustrate a point. It appears that the **primary factor** driving the growth in the Amador-Livermore Valleys is **not transportation, but rather land use constraints in other part of the region,** since both scenarios in the unconstrained simulation are less than that of the constrained land use simulation.

C. I-680 Corridor

As noted above, the I-680 Corridor **loses households** in the "build" scenario in the unconstrained housing simulation. When both scenarios are run in the **constrained housing** simulation, **no household change occurs.**

Statistical Analysis

In the unconstrained simulation testing the "build" and "no build" scenarios in the above corridors, a one-way and two-way ANOVA test was performed on the zones affected. Six zones had measurable changes in both scenarios. The ANOVA found **no** statistically significant difference between the zones. That is, the "build" and "no build" scenarios were not significantly different in terms of household location affect. The F-statistic for comparing each zone is 1.76445 at 5 degress of freedom and the P value is 0.2741458. The F-statistic for the column sums is 2.00243E-4. The column sum is looking at the sum of all zones for each scenario and comparing these sums. The degree of freedom was 1 and the P value is 0.989257.

Southern Alameda and Santa Clara Counties: Highway Corridors Impact Analysis

The "build" scenario in this simulation stimulates **increased sprawl** in Santa Clara County in terms of household locational decisions. The Morgan Hill (zone 51) and the Gilroy (zone 52) zones had a gain of about 6500 households. The Milpitas-West (zone 40) and North San Jose-Airport (zone 42) zones lost households.

This shift accounts for about 1 percent of the households in the county in the year 2010. Redistribution between these zones is also an illustrative example of the sensitivity of POLIS to travel time when land use constraints are removed. In Projections 90 (**constrained simulation**), ABAG estimates that about 12,000 households will be added to zones 40 and 42, and about 52,000 households will be added to zones 51 and 52. In the **Test 2** simulation (**unconstrained land use**), the "build" scenario allocated 84,000 households and the "no build" scenario added 90,000 households to the northern Santa Clara zones (zones 40 and 42). The southern Santa Clara zones (zones 51 and 52) received 48,000 households in the "build" scenario and 41,000 households in the "no-build" scenario.

What does the above suggest? There are two primary conclusions that can be drawn from the above. First, in an **unconstrained land use** simulation, in which locational decisions are influenced only by travel time and the relative attractiveness of a zone, households tend to locate closer to work sites. Second in the **constrained land use** simulation, where development policies substantially affected the locational choices of consumers, almost twice as many households located in the southern part of the county than in the unconstrained simulation. This simple illustration shows how **sensitive** POLIS is to travel time when the **reality** of land use policies is removed. Finally, this is another piece of evidence showing the impact of land use policies on **locational decisions**, and how POLIS picks up this impact.

Statistical Analysis

No ANOVA was used to test the null hypothesis that a significance difference existed between the zones affected, since the absolute number (four zones out of twenty five zones) and the absolute number of households that changed zones (about 1 percent) makes the test practically meaningless.

San Mateo and San Francisco Counties: 101 Corridor Analysis

In the **unconstrained land use** simulation, two of the twenty six POLIS zones are affected by the "build" and "no build" scenarios. Both zones are in San Mateo County. Given the constrained highway network that exists in the corridor, the model responded as might be expected. That is, the difference between the "build" and "no build" in terms of travel time difference simply does not influence the household location process. The reallocation of households in this corridor, accounted for 1.7 percent of the households in San Mateo in the year 2010.

Statistical Analysis

No ANOVA was used to test the null hypothesis that a significant difference existed between the "build" and "no build" scenarios, given the number of zones that were affected in the **unconstrained land use simulation.**

Marin and Sonoma Counties: 101 North Corridor

There are 13 analysis zones in this corridor. Almost 50 percent (6 zones) of these zones experienced a household locational changes between the "build" and "no build" scenario. The Marin County zones affected are: Ross/San Anselmo/Fairfax zone (zone 112), Corte Madera/Larkspur zone (zone 113) and the Sausalito/Mill Valley/Tiburon zone (zone 114). In Sonoma County, the affected zones are: Sebastopol (zone 103), Santa Rosa-East (zone 105) and Petaluma (zone 107). The Marin County zones are clustered adjacent to each other; whereas, the Sonoma County zones are more dispersed.

In the case of Marin County, the **unconstrained land use** simulation tends to cluster more households toward the southern end of the county. For example, in the **unconstrained land use** simulation, approximately 66,000 households are allocated to the affected Marin zones. ABAG's 2010 forecast (**constrained land use**) estimates no more than 50,500 households in the zones. In the northern Marin County zones of Novato (zone 110) and San Rafael/Lucas (zone 111), the **constrained land use** simulation estimates about 62,000 for the year 2010. In the **unconstrained land use** simulation, the households in the identified zones are 47,000. What is the significance of these changes? It illustrates (once again) the impact of land use on **constraining** the locational choices of households within the POLIS model. In the case of Marin, it also suggests that improvements in the highway network has **not** been the cause of the northern drift of population. Rather, **land use policies** have been the primary stimulating factor in the southern portion of the 101 North Corridor.

Analysis of the shifts within Sonoma County presents a different picture in terms of the network impact on land use. ABAG's latest forecast (PROJECTIONS 90) indicates that about 40 percent of the households in Sonoma County will be in zone 104 (Santa Rosa-West) and zone 105 (Santa Rosa-East) in the year 2010. This forecast is based upon economic, demographic and current land use policies. It reflects the **constrained land use** simulation. In the **unconstrained land use** simulation, locational changes occur that indicates that the transportation network has a greater impact on **decentralizing development patterns** in **this** county than in other areas analyzed up to this point. For example, the "build" simulation allocates about 36 percent of the households to the Santa Rosa zones. The "no build" scenario allocates about 42 percent of the county's households in the year 2010 to the Santa Rosa zone. Thus, the "build" scenario tends to put pressure on local land use policies outside of the Santa Rosa zones to increase housing potential.

Both the "build" and "no build" scenarios in the **unconstrained land use** simulation allocates more households away from the northern part of the county than would be permitted by local development policies. For example, in zone 102 (Northern Sonoma), ABAG forecasts that approximately 40,000 households will be living in this area by 2010. This is based upon existing development policies and is found in the **constrained land use** simulation. In the **unconstrained land use** simulation about 23,000 households are allocated to this zone.

In the **unconstrained land use** simulation, the "build" scenario appears to increase development pressure on the Sebastopol zone (zone 103) and the Petaluma zone (zone 107). The households that would locate in the Santa Rosa-East zone located in the Sebastopol and Petaluma zones. This further emphasizes the **decentralizing impact** of the highway network in his county. This is both true for both "build" and "no build."

Statistical Analysis

A two-way ANOVA was performed on the **unconstrained land use** "build" and "no build" scenarios. The analysis found that there was no significant difference (statistically) between the columns of "build" and "no build" zones in 2010. The F statistic is 0.000109 and the P value is 0.9921802. The statistical analysis doesn't deemphasize the above discussion about the apparent decentralizing impact of the highway network, particularly in Sonoma County. Rather, it shows (statistically) that although the influence exists, it is not sufficient to reject the null hypothesis that the differences are not significant. This is critical because what appears to be significant in the subjective world of "right" and "wrong," may not have the same validity when viewed from the objectivity of statistical analysis.

Napa and Solano Counties: Northern I-80 and Hwy 29 Corridors

In the **constrained land use** simulation, the transportation network was shown to have an insignificant impact on the allocation decisions of household. The solution was completely dominated by land use policies. In the **unconstrained land use** simulation, of the seven zones in the simulation, four had different results under the "build" and "no build" scenario. Among these, only 4 percent of the households actually changed zones in the "build" and "no build" scenarios. The "build" scenario tend to encourage more growth in the Benicia zone (zone 98) and less growth in the Rio Vista zone (zone 97). This is positive because the Benicia zone is "closer in" and is less sensitive to agriculture than the Rio Vista zone. The changes, however, are minor within the context of the unconstrained land use simulation.

What is significant, not so much the difference between the "build" and "no build" scenarios, is the difference between the constrained and unconstrained land use simulations. For example, the Rio Vista zone (zone 97) in Projections 90 has 4,500 households in the forecast for the year 2010 (constrained land use). In the unconstrained land use simulation, the "build" scenario jumps to 43,300, and the "no build" scenario rises to 49,600 households. The extreme difference between the constrained and unconstrained simulations points directly to the importance of land use policies in the POLIS system.

In general, it also suggests that any relaxation of land use policies in terms of permitting more development in the zone will probably have substantial impacts, regardless of the "build" and "no build" scenarios. The "build" and "no build" scenarios in the **unconstrained land use** simulation produces similar results for the Vallejo zone (zone 99), the Fairfield zone (zone 96) and the Vacaville zone (zone 95). The model suggests that improvements directly to the I-80 North Corridor do not substantially affect the development patterns in these communities. Once again, however, the significance is not between these scenarios, Rather, it is the difference between the constrained and unconstrained simulations.

In the forecast (constrained land use), ABAG estimates 153,000 will reside in the zones within the I-80 Corridor. In the unconstrained land use simulation, both the "build" and "no build" scenarios show only 99,000 households in the zones. The difference goes into the Benecia and Rio Vista zones.

In the Hwy 29 Corridor, about 5 percent of the households expected in the corridor by the year 2005 are affected by the "build" and "no build" scenarios in the **unconstrained land use** simulation. The "no build" scenario locates more households in the Napa City zone (zone 100) and less in the Calistoga/Yountville/St.Helena zone (zone 101). This does suggest the sensitivity of the corridor to development in this county. Once again, the more interesting question is the difference between the unconstrained and constrained simulation. The unconstrained simulation places 3,000 more households in the northern zone than is called for in the land use policies of the area. Correspondingly, it reduces growth in the Napa zone. It does suggest that access above the Napa zone places developmental pressures, regardless of the type of scenario, on these communities. It also tends to give strong support for the county's general plan that is highly restrictive of growth in areas north of Napa City. Any relaxation of growth controls will stimulate development in the area, since the model suggests that these zones are highly attractive to household location.

Statistical Analysis

Only 4 percent of the households expected to be in the I-80 and Hwy 29 corridors were affected by the "build" and "no build" scenarios in the **unconstrained land use** simulation. No ANOVA test was run because of the small number affected. As noted earlier, the real interest in analyzing these corridors was not in the scenarios. Rather, it was in the difference between each simulation. The **constrained land use** simulation showed that either scenario did not affect the final outcome. When land use policies are relaxed in the **unconstrained land use** simulation, the results, regardless of the "build" or "no build" scenarios, indicated greater decentralization of living patterns.

This decentralization was influenced by both consumer preferences, as defined in the model, and the transportation network. This pattern, however, could only occur with a **relaxation** of land use constraints.

Eighty-six zones out of one hundred and fourteen zones had employment reallocated when land use constraints were removed from the POLIS model. Of this total, thirty-seven had more than 1,000 jobs that had shifted, due to network and locational preference factors embedded in the model. The total shift accounted for about 53,000 jobs or 1.3 percent of the total expected regional jobs in the year 2010. The analysis suggests that job location decisions in POLIS are more sensitive to the transportation network. One, however, would normally think that job location would show more sensitivity to the transport network than that of household location decisions. The network affects the cost of doing business and the efficiency of the flow of goods and information. POLIS incorporates this logic by using the previous periods employment in the zone as an attractor, employment densities which affect the economies of locational space, commercial and industrial land availability which affects locational costs, and the population in a zone and travel time between zones.

Alameda-Contra Costa Counties: I-80; I-880 and I-680 Impacts

The shifts that occurred between these corridors in the analysis of household locations were not as dramatic in the employment location part of the picture. Much of the shifts between zones were within corridors. Although more job movement occurred, it was not from one corridor to another. Having said the above, minor shifts in job locations did occur between corridors. For example, the "build" scenario increased the attractiveness of the I-80 corridor and decreased the attractiveness of the I-680 corridor. That is, the "build" scenario added about 6,300 more jobs in the I-80 corridor than the "no build." The I-680 corridor lost about the same number in the "build." This accounts for a 2 percent gain in the I-80 corridor above the "no build" scenario. For both the I-880 and the Hwy-4 corridors, the "build" and "no build" scenarios resulted in no appreciable change. In both cases, the job shifts were in the category of +-1,000 or fewer jobs.

The differences between the **constrained land use** and **unconstrained land use** simulations are worth noting, since they raise some interesting locational factors that POLIS has helped identify. Table 2 shows the difference between the **forecast 2010**, the **"build" 2010** and the **"no build" 2010** for the primary corridors in Alameda and Contra Costa counties. The substantive shifts in job location preferences, as shown in Table 2, comes between the Hwy-4 and I-680 corridors and between the forecast and the "build/no build" 2010 simulations. Both the "build/no build" show more job growth in the Hwy-4 corridor than the forecast 2010. Part of the reason for this difference comes from agglomeration economies that are occurring in the I-680 corridor and not in the Hwy-4 corridor. Agglomeration economies refer location of firms or activities that locate near to each other for reasons that range from information needs, specialized labor or technology. This may involve the sharing of subcontractors and specialized service firms, the formation of labor service pools or the sharing of technology or market information. Regardless of the specific reason, the objective to create an environment that maximizes competitiveness.

In the paper, **Primary Central Business Districts in the San Francisco Bay Area**, by Brady and Yang (February 1991), the authors point out the majority of growth in business services in Contra Costa County occurred in the business districts of Concord and Walnut Creek. The location of these firms has less to do with transportation access and more to do with agglomerating to maximize the conditions outlined above.

The policy issue presented here is: "what policies would stimulate agglomeration economies in the Hwy-4 corridor that would intensify job growth, and hence move the forecast in the direction that POLIS is suggesting **should** happen?" The answer will not be broached in the context of this paper, but clear options do exist.

This stroll into agglomeration economics was done to point out another aspect of the usefulness of the POLIS model. That is, identifying corridors that may not be reaching their economic potential.

Table 3
Number of Jobs by Corridor in POLIS Simulations in the Year 2010

Development Corridor	**Forecast**	**"Build"**	**"No Build"**
I-80	291,900	289,800	283,500
Hwy-4	76,300	94,700	94,800
I-680	361,000	340,700	346,300
I-880	459,100	458,800	457,700

Source: ABAG

Table 2 also illustrates that the "potential" of the East Bay corridors likely will not change between the forecast and the "build/no build" simulations. The "no build" scenario, however, does appear to weaken the linkages that maintain the economic potential of the corridors. That is, it likely raises congestion costs vis-a-vis other areas in the region.

A brief analysis of individual corridors will follow to provide greater depth.

A. I-80 Corridor

The "build" scenario points to higher employment potential in the San Pablo zone (zone 80) than the "no build." The 2010 employment in the "build" scenario is 17,100; in the "no build" scenario the number is 15,600. The Richmond zone (zone 81) and the El Cerrito zone (zone 82) have no change, and the Pinole zone (zone 83) has only a slight insignificant decline in jobs (-113).

The northern portion of the corridor shows increased employment potential as a result of the "build" scenario. The Albany, South Berkeley zone (zone 53) increases 9.5 percent or by almost 3,000 jobs and the North Oakland/Emeryville zone (zone 55) increase 6.9 percent or by almost 2,000 jobs. Therefore, the "build" scenario appears to generate long term employment benefits to these East Bay communities.

B. I-880 Corridor

There was no significant change in the corridor in the "build" or "no build" scenarios in terms of job location potentials. There is some improvement in the Oakland zones due to the "build" scenario, with a corresponding loss in the southern zones. The shift amounts to about 7,000 jobs or about 1.5 percent of the jobs in the corridor. The shift, however slight, might reflect improved access by a broader labor market witin this portion of the corridor.

C. I-680 Corridor

The "build" or "no build" scenarios has little or no impact on the job potential in the northern part of the corridor, the Concord-Pleasant Hill-Walnut Creek corridor. The different scenarios did impact the southern portion of the corridor. The Alamo-Danville zone (zone 90) had its job potential decline by 1,300 jobs in the "build" scenario, and while the San Ramon Valley zone (zone 91) had a reduction in 1,900 in its jobs potential. Most of these jobs shifted to the East Bay shoreline zones due to improvements in the network in that part of the region. The greatest decline in job potential occurred in the southern I-680 corridor in the Pleasanton zone (zone 78) and the Livermore zone (zone 79). The shift of households to the I-880 zones in the **unconstrained land use** simulation, along with improved access resulted in the Pleasanton zone having 7.9 percent or 4,100 fewer jobs in the "build" scenario than in the "no build" scenario. The Livermore zone fell by 600 jobs. Much of this lost employment potential shifted to the Berkeley-North Oakland zone.

The above analysis suggests, for highly developed urban corridors, that network improvements tend to strengthen the economic competitiveness of those areas vis-a-vis newer and, more likely, auto-intensive land use areas.

Southern Alameda and Santa Clara Counties: Highway Corridors Impact Analysis

As noted earlier, the model in the "build" scenario increased the job potential in the Oakland zones and reduced some of the potential in the southern Alameda zones. In specific, the Newark zone (zone 74) is hit hard with a drop in 4,700 jobs. Some of this drop shifts to the Fremont Baylands (zone 73) which is adjacent to the zone. The Baylands zone increase by 2,300 jobs. The Fremont NE zone (zone 76) also suffers a loss of job potential in the "build" scenario of about 2,000 jobs.

The shift appears to be partly associated with the reduction in congestion in the northern I-80 corridor, as well as greater accessibility to the northern-880 zones. The Milpitas zones 40 and 41 are not affected by the "build" or "build" scenarios.

Both the "build" and "no build" scenarios tend to **decentralize** employment potential more than that which is in the forecast for the year 2010. For example, in the western coastal range portion of Santa Clara County, zone 30 (Cupertino zone), zone 36 (Los Gatos-Saratoga zone) and zone 50 (San Jose-Alamden zone), all experienced higher job allocations than that of the forecast for the year 2010. In the forecast (**constrained land use**), ABAG estimates about 90,000 jobs would be located in these zones in 2010. In the "**unconstrained land use** simulation, the "build" scenario projects 105,600 jobs and the "no build" projects 101,000 jobs. This suggests the transportation network in this part of the county could potentially encourage the **shifting of jobs** to these zones (**given land use policies that would make such a shift possible**) from other parts of the county.

To illustrate the impact of the network on **decentralizing** employment potential, eight zones are analyzed. Five of the zones are in the northern portion of the county. These zones are where county and city planners would like to see job growth concentrated. The three southern zones are in San Jose's Sphere-of-Influence. ABAG forecasts (**constrained land use**) for the northern zones of Sunnyvale-North (zone 32), Santa Clara (zone 33), Milpitas-West (zone 40), Milpitas-East (zone 41) and North San Jose-Airport (zone 42) for the year 2010 more than 412,000 jobs in these zones. In the southern zones of San Jose-Evergreen (zone 46), San Jose-Edenvale-North (zone 48) and San Jose-Edenvale-South (zone 49), ABAG forecasts about 73,000 jobs in the year 2010.

In both the "build" and "no build" **unconstrained land use** simulation, the southern zones are allocated more job growth than the northern zones. In the "build" scenario 360,000 jobs are allocated to the northern zones. In the southern zones 113,000 jobs are allocated in the year 2010. In the "no build" scenario, 356,000 jobs are allocated to the northern zones and 115,000 jobs to the southern zones.

What does the above suggest? First, the "natural" tendency of the transportation network is toward decentralization in Santa Clara County. Given this tendency, the critical force that will direct development will be land use policy. Without restrictive land use policies that focus growth into specific corridors, sprawl will easily occur. Second, the basic network structure in Santa Clara is in place. Simulation shows very little difference between the "build" and "no build" scenarios. Actually, the "build" scenario concentrates employment more than the "no build." To reemphasize, the city and county planning department must coordinate development plans in order to minimize the "natural" tendency to sprawl in the county. The model suggests that the redevelopment activity in downtown San Jose could miss it target of growth without efforts to **concentrate growth.** For example, in the San Jose-Central zone (zone 39), which contains San Jose's redevelopment activity, the ABAG forecast estimates 112,000 jobs in the year 2010.

Both the "build" and "no build scenarios of the **unconstrained land use** simulation allocate 84,000 and 85,000 jobs respectively. Competing area will affect redevelopment efforts unless land use policies can channel growth into the zone.

San Mateo and San Francisco Counties: 101 Corridor Analysis

The corridor is highly developed with little significant change, given both the "build" or "no build" scenarios. In the case of San Francisco County, about 5,100 jobs shift between zones given either scenario. This is less than 1 percent of the estimated total jobs in San Francisco in the year 2010.

As has been repeated in earlier parts of this report, the most useful analysis is in comparing the **constrained and unconstrained land use simulation**. San Francisco County is a useful case study which shows the sensitivity of POLIS to travel time, and the importance of land use policies in effectively managing internal growth. Two of the critical employment zones in San Francisco are the Downtown zone (zone 4) and the South-of-Market zone (zone 9). These zones are central employment core zones. In ABAG's forecast for the year 2010 in the **constrained land use** simulation, approximately 374,000 jobs are concentrated into these zones. In both the "build/no build" scenario in the **unconstrained land use** simulation, the model allocates 306,000 jobs to the zones. The difference goes to other zones throughout San Francisco. This suggests that (a) development pressures for job relocation exists throughout San Francisco, and (b) city policy must continue to restrict growth to well defined areas of the community.

In San Mateo County, the difference between the **constrained and unconstrained land use** simulation is minimal. This suggests that network improvements have little land use impacts. There are, however, exceptions. For example, the Pacific/Half Moon Bay zone (zone 19) increases in employment potential for the year 2010 in both the "build/no build" scenario in the **unconstrained land use simulation** when compared to the ABAG forecast for the zone. The amount is not significant in absolute change. That is, an increase in 4,000 jobs above the forecast 2010 level, but it represents about a 30 percent increase in percentage terms. Therefore, it would suggest that network improvements in this area should be viewed as potentially affecting the development potential of the zone. Once again, restrictive land use policies would minimize the pressure.

Marin and Sonoma: 101 North Corridor Impact Analysis

In Marin County, the "build" scenario has the effect of shifting job development pressures from the northern part of the county to the southern and central parts. The Novato zone (zone 110) loses about 3,200 jobs which move to the San Rafael (zone 111) and the Corte Madera/Larkspur (zone 113) zones. The majority of the shift goes into the Corte Madera/Larkspur zone. The "no build" scenario tends to concentrate growth in the Novato and San Rafael zones.

If the San Rafael and Novato zones are combined, the difference between the "build" and "no build" scenarios is only 1,900 jobs. Both the "build" and "no build" scenarios, however, allocate fewer jobs to these two zones than ABAG's forecast for the year 2010. This indicates that development pressure exists up and down the corridor, and only land use policy that centralizes employment will effectively reduce the tendency of jobs to spread throughout the zones.

In Sonoma County, the "build" or "no build" scenarios have little impact on the job concentration in the Santa Rosa zones (Santa Rosa-West and Santa Rosa-East). Both zones capture about 105,000 jobs in the year 2010. However, when these zones are looked at in more detail, a discernible change occurred between Santa Rosa-West (zone 104) and other zones in the northern corridor. The "build" scenario had the impact of dispersing jobs to the Northern Sonoma (zone 102) and the Petaluma (zone 107). The shift to the Petaluma zone in the "build" scenario is viewed as insignificant, since the "build" scenario in the **unconstrained land use** simulation allocate 22,900 jobs to this zone, and the ABAG forecast for the zone for 2010 in the **constrained land use** simulation is virtually the same. The problem is in the Northern Sonoma zone. The "build" and the "no build" scenarios tend to allocate more jobs than ABAG's forecast. This suggests that the existing transportation network--independent of the existing "build/no build" scenarios--will probably facilitate already existing development pressures to further decentralize jobs into the northern portion of the corridor.

Napa and Solano Counties: Northern I-80 and Hwy 29 Corridor Analysis

In the case of the Hwy 29 Corridor, the "build" scenario of the **unconstrained land use simulation** tends to concentrate development pressures in the City of Napa. The "build" scenario allocates more jobs to the Napa City zone (zone 100) than to the northern zone 101 (Calistoga/ Yountville/ St.Helena). Whereas, the "no build" scenario tends to concentrate more jobs in the northern corridor.
The "build" scenario's employment allocation is similar to that of the forecast for the year 2010 for the Napa City zone. The shift in these zones is insignificant in overall county growth. The shift accounts for about 2.2 percent of the jobs in the year 2010 in the county.

Of most concern is the shifts occurring within Solano County both in the "build" and "no build" scenarios when viewed in the context of the **constrained and unconstrained land use simulation.** Of particular concern is the Rio Vista zone (zone 97). ABAG has forecast about 2000 jobs in this zone in 2010, based upon development potential in the county and other economic forces. With the removal of development potential constraints, the job allocation leaps to 50,000 in the "build" scenario and 46,000 in the "no build" scenario. All of the primary corridor zones (Vallejo, Vacaville/ Dixon, Fairfield/Suisun) lose employment potential. Critically viewed, it indicates that this zone is **very sensitive to any network changes.** Put in perspective, this zone is the most sensitive zone in the Bay Area in terms of development impacts as a result of transportation network changes.

SENSITIVITY OF THE POLIS LAND USE/TRANSPORTATION MODEL

The above analysis has shown that the POLIS modelling system at ABAG is sensitive to both land use constraints and travel time. It provides the user with the capability to both forecast future job and housing distribution, and to ask "what if" questions about changes in travel time and land use configurations. The model has shown that highway networks may or may not contribute to further spatial decentralization. The network, combined without other location factors, determines whether it will contribute the decentralization. In short, highway improvements **in and of themselves do not create a cause and effect relationship**. The cause and effect relationship comes from an interaction with land use, the physical location of the network and the level of existing development where the network changes are proposed.

DEFINING "BUILD" AND "NO BUILD" SCENARIOS IN THE UNCONSTRAINED LAND USE SIMULATION

This paper has examined the "build" and "no build" transportation scenarios provided by MTC to ABAG. The definitions of "build" and "no build" should not be viewed solely in terms of adding capacity or not adding capacity to the existing highway network. Rather, the scenarios should be viewed in terms of the impact of congestion on the distribution of jobs and households. Eliminating this congestion should be viewed as the key to stabilizing the existing decentralizating growth pattern in the Bay Area. The way one eliminates congestion may vary from highway improvements to applying user fees to the network.

CONCLUSION

This paper has outlined the linkages which exist between the various components of the ABAG modelling system. An analysis of the impacts of the latest Transportation Improvement Program of the Metropolitan Transportation Commission was also an objective of this study, along with an intensive evaluation of the sensitivity of the POLIS land use/Transportation model.

The above analysis has shown that transportation networks affect land use patterns differently, and that simple answer(s) to the direction of change and interaction between land use, and the highway network are rare. In some cases, the highway network appears to place pressure on land use to continue spatial dispersion of the urban centers. In others, it has been shown that network improvement actually has the reverse affect, such as in the Bayshore improvements proposed in Alameda and Contra Costa counties. Hence, a major conclusion of this research effort is that no **consistent cause and effect relationship exists.**

Generalizations about cause and effect relationships between land use and transportation when applied to a complicated setting with substantial interaction, such as the urban environment, may result in poor public policy, bad economics and ultimately hurt people.

The analysis has further shown that the POLIS model is quite sensitive to travel time changes. Most significantly, the system used in the context of this study provides the user with substantial information on locational development pressures. This is critical information because it permits us to raise "what if" questions in the context of land use controls and transportation interaction. Since the model seeks to solve the location choices of firms and individuals in the context of minimizing the opportunity cost associated with any location, it gives an excellent picture of a **potential future** for policy analysis.

APPPENDIX A

ABAG'S MODELLING SYSTEM

ABAG Projection Process

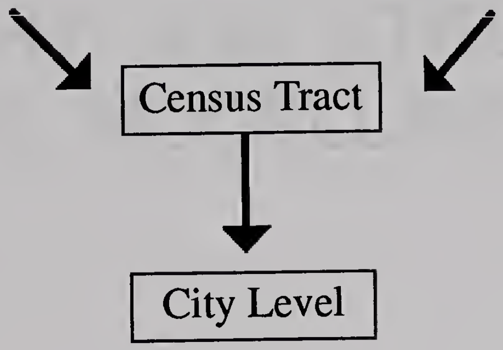
- Projection of Demand

  - Assumptions about regional growth.
  - Forecast of employment demand for manufacturing, services, trade and other.
  - Required labor force to meet demand.
  - Population and housing.

- Assessment of Supply

  - Collection of zoning, policy information from local governments.
  - Analysis of land identified for development.
  - Assessment at regional level of supply of land for housing and job growth.

County Projection Process



Demand Analysis

- Statistical time series models
  - Employment
  - Population
  - Housing

Census Tract

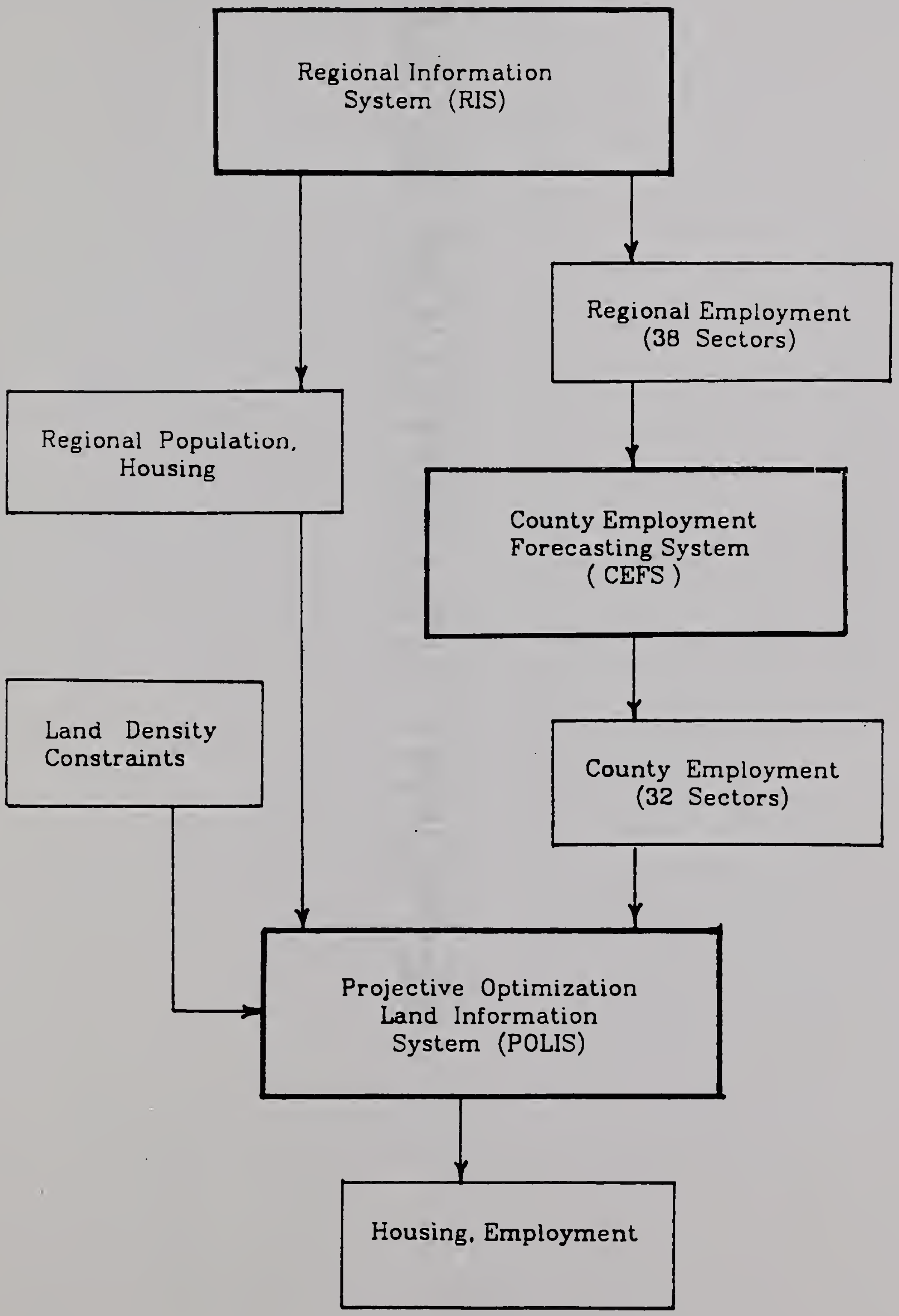
City Level

Supply Analysis

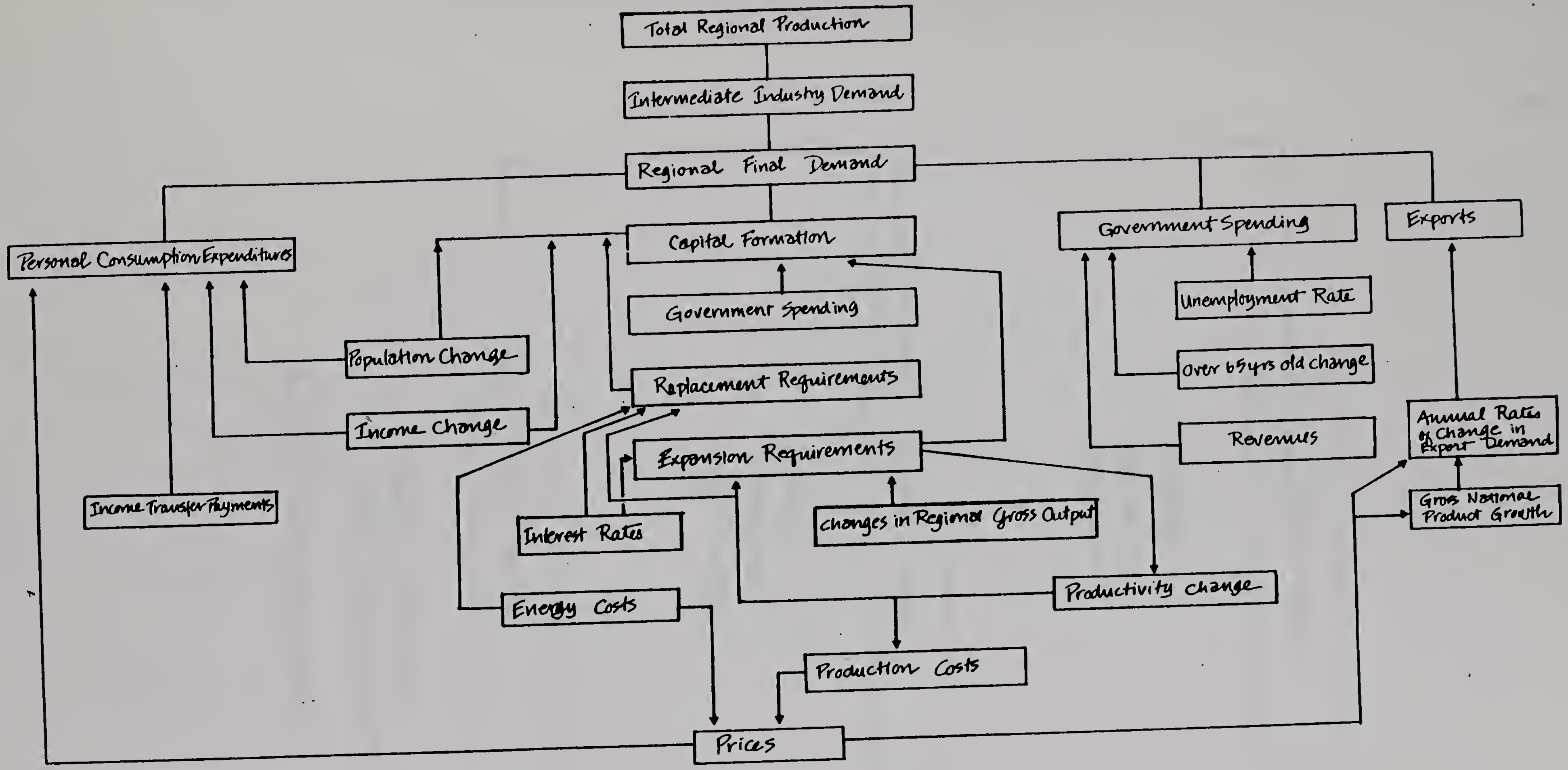
- Land use information used to distribute growth projected for county.

THEORY AND STRUCTURE OF ABAG MODELLING SYSTEM

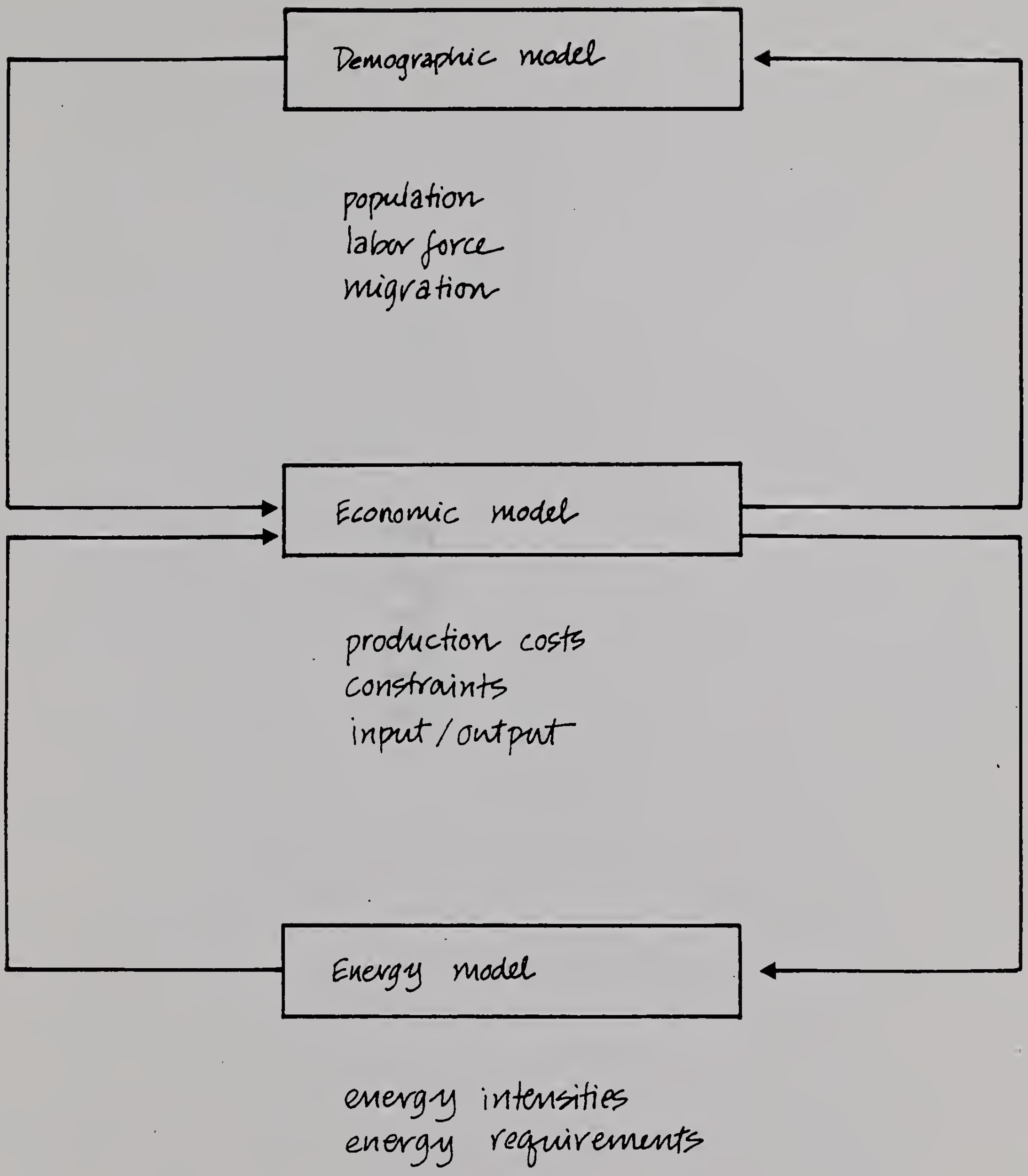
The Modeling System of ABAG


Regional Information System (RIS)
Regional Employment (38 Sectors)
Regional Population, Housing
County Employment Forecasting System (CEFS)
Land Density Constraints
County Employment (32 Sectors)
Projective Optimization Land Information System (POLIS)
Housing, Employment

REGIONAL INFORMATION SYSTEM



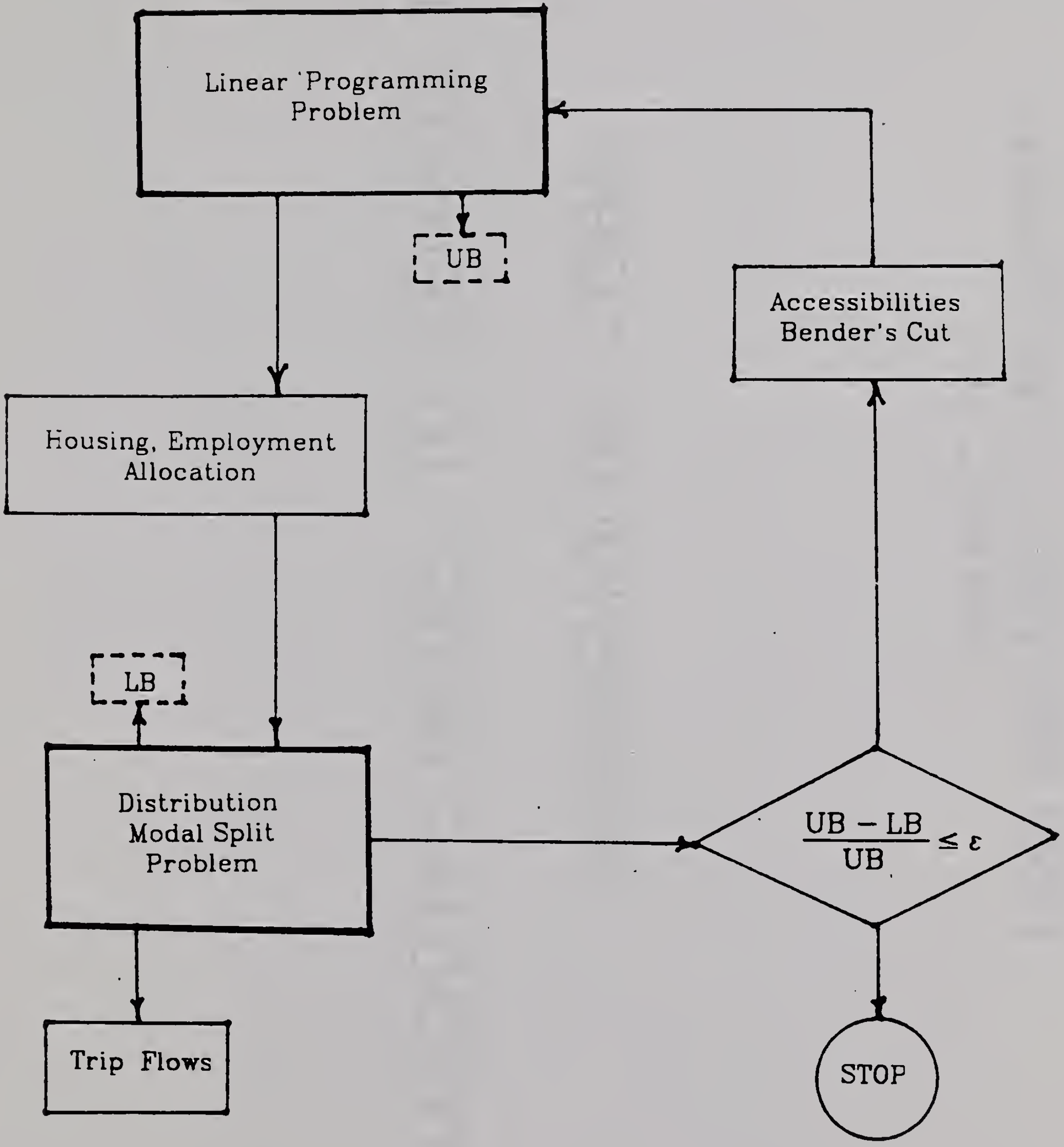
ECONOMIC FORECASTING MODEL



Regional Information System

POLIS

The Solution Algorithm


Linear Programming Problem
UB
Accessibilities Bender's Cut
Housing, Employment Allocation
LB
Distribution Modal Split Problem
$\frac{UB - LB}{UB} \leq \varepsilon$
Trip Flows
STOP

ALLOCATIVE MODEL TO CENSUS TRACT

HOUSEHOLDS, JOBS

SUBJECT TO
LAND AVAILABILITY AND DENSITY

Potential Problems

- Land - in and of itself - does not create development.
- ABAG does not literally follow local development policies.

  Policies do not reflect economic factors, business cycles, gains and loss of employment; housing production affected more by market than policy.

- Timing of development.
- Estimating employment by use of area per worker factors.
  - Maximum potential.
  - No time.
  - No economic considerations.

Review Process

- Technical Advisory Committee
    - Private Sector - Banks, PG&E, Private Forecasting Firms
    - Public Sector - County Planning Departments

- Local Review by Governments

- Final Projections

- Updating
    - Continuous Process

APPENDIX B

RESULTS OF THE "BUILD" AND "NO BUILD" SCENARIOS WITH THE CONSTRAINED AND UNCONSTRAINED LAND USE SIMULATION

Comparing POLIS 2010 allocations WITH and WITHOUT Highway Development
This scenario INCLUDES LAND AVAILABILITY CONSTRAINTS (Test 1)

COUNTY	ZONE		Maximum Allowed Local Land Use Potential (Household)	Household Allocations WITH HWY Development Policies	Household Allocations WITHOUT HWY Development Policies	Absolute Diff	Percent Diff	Maximum Allowed Local Land Use Potential (Employment)	Employment Allocations WITH HWY Development Policies	Employment Allocations WITHOUT HWY Development Policies	Absolute Diff	Percent Diff
SAN	1	SF-RICHMOND	34145	33934	33934	0	0.0	33155	33155	33155	0	0.0
FRANCISCO	2	SF-MARINA	26907	26907	26907	0	0.0	15019	15019	15019	0	0.0
	3	SF-NORTHEAST	40207	38605	40207	-1602	-4.0	96005	96005	96005	0	0.0
	4	SF-DOWNTOWN	29194	29194	29194	0	0.0	282058	268213	268213	0	0.0
	5	SF-WESTERN ADDIT	28215	28215	28215	0	0.0	34352	34352	34352	0	0.0
	6	SF-BUENA VISTA	15345	15345	15345	0	0.0	8225	8225	8225	0	0.0
	7	SF-CENTRAL	20118	20118	20118	0	0.0	5534	5534	5534	0	0.0
	8	SF-MISSION	21935	21935	21935	0	0.0	38214	38214	38214	0	0.0
	9	SF-SOUTH OF MARK	28238	27837	26176	1661	6.3	105656	105656	105656	0	0.0
	10	SF-SOUTH BAYSHOR	8527	8527	8527	0	0.0	35993	35993	35993	0	0.0
	11	SF-BERNAL HEIGHT	8590	8590	8590	0	0.0	4956	4956	4956	0	0.0
	12	SF-SOUTH CENTRAL	23399	23151	23151	0	0.0	8454	8454	8454	0	0.0
	13	SF-INGLESIDE	20269	20014	20014	0	0.0	13556	13556	13556	0	0.0
SAN	14	SF-INNER SUN SET	21709	21415	21474	-59	-0.3	17230	17230	17230	0	0.0
FRANCISCO	15	SF-OUTER SUN SET	25625	25313	25313	0	0.0	8317	8317	8317	0	0.0
SAN	16	DALY CITY/BRISBA	36758	36758	36758	0	0.0	37997	37997	37997	0	0.0
MATEO	17	SOUTH SAN FRANCI	20562	20562	20562	0	0.0	47913	47913	47913	0	0.0
	18	SAN BRUNO	14619	14619	14619	0	0.0	20904	20904	20904	0	0.0
	19	PACIFICA/HALF MN	28816	27165	27165	0	0.0	11934	11934	11934	0	0.0
	20	MILLBRAE/BURLING	27200	27200	27200	0	0.0	54693	50088	50088	0	0.0
	21	SAN MATEO	35678	35678	35678	0	0.0	57398	56508	56508	0	0.0
	22	BELMONT/SAN CARL	23523	23523	23523	0	0.0	36791	36791	36791	0	0.0
	23	FOSTER CITY	16928	16928	16928	0	0.0	23276	23276	23276	0	0.0
	24	REDWOOD CITY/ATH	40370	40370	40370	0	0.0	58804	56637	56637	0	0.0
SAN	25	MENLO PK/E PALO	24882	24882	24882	0	0.0	38257	38257	38257	0	0.0
MATEO	26	PORTOLA VLLY/WOO	7815	7815	7815	0	0.0	3327	3327	3327	0	0.0
SANTA	27	PALO ALTO	26712	26712	26712	0	0.0	86719	79522	80545	-1023	-1.3
CLARA	28	L ALTOS/L ALTOS	21576	21576	21576	0	0.0	22402	22402	22402	0	0.0
	29	MOUNTAIN VIEW	27757	27757	27757	0	0.0	80744	80095	79812	283	0.4
	30	CUPERTINO	21687	21687	21687	0	0.0	59204	58078	58200	-122	-0.2
	31	SUNNYVALE-SOUTH	29152	29152	29152	0	0.0	18581	18581	18581	0	0.0
	32	SUNNYVALE-NORTH	26574	26574	26574	0	0.0	94489	91758	91758	0	0.0

COUNTY	ZONE		Maximum Allowed Local Land Use Potential (Household)	Household Allocations WITH HWY Development Policies	Household Allocations WITHOUT HWY Development Policies	Absolute Diff	Percent Diff	Maximum Allowed Local Land Use Potential (Employment)	Employment Allocations WITH HWY Development Policies	Employment Allocations WITHOUT HWY Development Policies	Absolute Diff	Percent Diff
	33	SANTA CLARA	41576	41576	41576	0	0.0	145913	145752	145913	-161	-0.1
	34	SJ-WEST VALLY	26081	26081	26081	0	0.0	22213	22213	22213	0	0.0
	35	CAMPBELL	25410	25410	25410	0	0.0	35305	35305	35305	0	0.0
	36	LOST GATOS-SARAT	30463	30463	30463	0	0.0	24543	24543	24543	0	0.0
	37	SJ-CAMBRIAN (PAR	19157	19157	19157	0	0.0	13788	13788	13788	0	0.0
	38	SJ-WILLOW GLEN	29142	29142	29142	0	0.0	22777	22777	22777	0	0.0
	39	SJ-CENTRAL	34721	34721	34721	0	0.0	112403	112403	112403	0	0.0
	40	MILPITAS WEST	9880	9880	9880	0	0.0	90442	79003	77980	1023	1.3
	41	MILPITAS EAST	13806	13806	13806	0	0.0	6499	6499	6499	0	0.0
	42	NORTH SJ AIRPORT	2173	2173	2173	0	0.0	89086	89086	89086	0	0.0
	43	SJ-BERRYESSA	21293	21293	21293	0	0.0	31495	31495	31495	0	0.0
	44	ALUM ROCK-WEST	14814	14814	14814	0	0.0	11366	11366	11366	0	0.0
	45	ALUM ROCK-EAST	19920	19920	19920	0	0.0	9284	9284	9284	0	0.0
	46	SJ-EVERGREEN	32091	32091	32091	0	0.0	17740	17740	17740	0	0.0
	47	SJ-SOUTH	33733	33733	33733	0	0.0	32545	32545	32545	0	0.0
	48	SJ-EDENVALE-NORT	27778	27778	27028	750	2.8	10704	10704	10704	0	0.0
	49	SJ-EDENVALE SOUT	21247	21247	21247	0	0.0	44406	44406	44406	0	0.0
	50	SJ-ALMADEN	18761	18761	15763	2998	19.0	7374	7374	7374	0	0.0
SANTA	51	MORGAN HILL	31080	27332	31080	-3748	-12.1	56029	56029	56029	0	0.0
CLARA	52	GILROY	22064	22064	22064	0	0.0	42663	42663	42663	0	0.0
ALAMEDA	53	ALBANY,S. BERKEL	27547	27547	27547	0	0.0	32540	32540	32540	0	0.0
	54	BERKELEY HILLS-U	27710	27710	27710	0	0.0	47999	46585	46585	0	0.0
	55	N OAKLAND/EMERYV	22103	22103	22103	0	0.0	29311	29311	29311	0	0.0
	56	WEST OAKLAND	27833	27833	27833	0	0.0	115139	102632	102632	0	0.0
	57	ALAMEDA-NORTH	9890	9890	9890	0	0.0	25210	25210	25210	0	0.0
	58	ALAMEDA-SOUTHSHO	16915	16915	16915	0	0.0	11356	11356	11356	0	0.0
	59	HARBOR BAY ISLE	5211	5211	5211	0	0.0	14583	12754	12754	0	0.0
	60	OAKLAND-FRUITVAL	21273	21273	21273	0	0.0	14388	14388	14388	0	0.0
	61	OAKLAND-580 FOOT	27430	27430	27430	0	0.0	15901	15901	15901	0	0.0
	62	OAK-MONTCLAIR/PI	16778	16778	16778	0	0.0	7295	7295	7295	0	0.0
	63	OAKLAND SEMINARY	21421	21421	21421	0	0.0	17157	17157	17157	0	0.0
	64	OKLAND AIRPORT-C	3736	3736	3736	0	0.0	34517	34060	34060	0	0.0
	65	E OAKLAND/GOLF L	20730	20730	20730	0	0.0	14913	14913	14913	0	0.0
	66	SAN LEANDRO	32115	32115	32115	0	0.0	48704	48704	48704	0	0.0
	67	SAN LORENZO/ASHL	20727	20727	20727	0	0.0	13687	13687	13687	0	0.0
	68	CASTRO VALLEY	27968	27968	27968	0	0.0	13983	13983	13983	0	0.0
	69	HAYWARD-EAST	33018	33018	33018	0	0.0	16983	16983	16983	0	0.0

COUNTY	ZONE		Maximum Allowed Local Land Use Potential (Household)	Household Allocations WITH HWY Development Policies	Household Allocations WITHOUT HWY Development Policies	Absolute Diff	Percent Diff	Maximum Allowed Local Land Use Potential (Employment)	Employment Allocations WITH HWY Development Policies	Employment Allocations WITHOUT HWY Development Policies	Absolute Diff	Percent Diff
	70	HAYWARD-WEST	30628	30628	30628	0	0.0	71570	71570	71570	0	0.0
	71	UNION CITY EAST	11093	11093	11093	0	0.0	7154	7154	7154	0	0.0
	72	UNION CITY WEST	8844	8844	8844	0	0.0	7741	7741	7741	0	0.0
	73	FREMONT BAYLANDS	11916	11916	11916	0	0.0	43746	43746	43746	0	0.0
	74	NEWARK	14071	14071	14071	0	0.0	29423	29423	29423	0	0.0
	75	FREMONT CENTRAL	30389	30389	30389	0	0.0	31849	31849	31849	0	0.0
	76	FREMONT-NORTH,EA	34631	34631	34631	0	0.0	21229	21229	21229	0	0.0
	77	DUBLIN	10096	10096	10096	0	0.0	19667	19667	19667	0	0.0
	78	PLEASANTON	44115	44115	44115	0	0.0	77691	77691	77691	0	0.0
ALAMEDA	79	LIVERMORE	42193	38612	38612	0	0.0	43130	43130	43130	0	0.0
CONTRA	80	SAN PABLO	16826	16826	16826	0	0.0	22268	21723	21674	49	0.2
COSTA	81	RICHMOND	36174	36174	36174	0	0.0	41387	35456	35456	0	0.0
	82	EL CERRITO	15109	15109	15109	0	0.0	8762	8762	8762	0	0.0
	83	PINOLE	25631	25631	25631	0	0.0	15122	15122	15122	0	0.0
	84	MARTINEZ	8654	8654	8654	0	0.0	20661	20661	20661	0	0.0
	85	CONCORD-WEST	22463	22463	22463	0	0.0	54119	54119	54119	0	0.0
	86	CONCORD/CLAYTON	36287	36287	36287	0	0.0	18388	18388	18388	0	0.0
	87	WALNUT CREEK	35868	35868	35868	0	0.0	54509	54509	54509	0	0.0
	88	PLEASANT HILL/WC	31532	31532	31532	0	0.0	32226	32226	32226	0	0.0
	89	LAF/MORAGA/ORIND	21556	21556	21556	0	0.0	16296	16296	16296	0	0.0
	90	ALAMO-DANVILLE-S	30861	30861	30861	0	0.0	19056	19056	19056	0	0.0
	91	SAN RAMON VALLEY	17450	17450	17450	0	0.0	42955	41571	41621	-50	-0.1
	92	PITTSBURG	30210	30210	30210	0	0.0	20285	20285	20285	0	0.0
CONTRA	93	ANTIOCH	32566	32566	32566	0	0.0	25842	25842	25842	0	0.0
COSTA	94	BRENTWOOD	40004	37613	37613	0	0.0	9688	9688	9688	0	0.0
SOLANO	95	VACAVILLE/DIXON	48151	48151	48151	0	0.0	44196	44196	44196	0	0.0
	96	FAIRFIELD SUISUN	61136	61136	61136	0	0.0	69169	69169	69169	0	0.0
	97	RIO VISTA	4519	3490	3490	0	0.0	2002	2002	2002	0	0.0
	98	BENICIA	14670	14670	14670	0	0.0	12715	12715	12715	0	0.0
SOLANO	99	VALLEJO	44453	44453	44453	0	0.0	65389	61607	61607	0	0.0
NAPA	100	NAPA CITY	44566	44237	44237	0	0.0	54363	54363	54294	69	0.1
NAPA	101	CALISTOGA/YOUNT/	10863	10863	10863	0	0.0	14235	12902	12971	-69	-0.5
SONOMA	102	NORTHERN SONOMA	40233	38974	38974	0	0.0	25262	25262	25262	0	0.0
	103	SEBASTOPOL	12086	12086	12086	0	0.0	10136	10136	10136	0	0.0

COUNTY	ZONE		Maximum Allowed Local Land Use Potential (Household)	Household Allocations WITH HWY Development Policies	Household Allocations WITHOUT HWY Development Policies	Absolute Diff	Percent Diff	Maximum Allowed Local Land Use Potential (Employment)	Employment Allocations WITH HWY Development Policies	Employment Allocations WITHOUT HWY Development Policies	Absolute Diff	Percent Diff
	104	SANTA ROSA-WEST	35694	35694	35694	0	0.0	44732	44732	44732	0	0.0
	105	SANTA ROSA-EAST	49955	49955	49955	0	0.0	69651	65616	65611	5	0.0
	106	ROHNERT PARK/COT	27729	27729	27729	0	0.0	32200	32200	32200	0	0.0
	107	PETALUMA	27349	27349	27349	0	0.0	22973	22973	22973	0	0.0
SONOMA	108	SONOMA	18713	18713	18713	0	0.0	11056	10867	10872	-5	-0.0
MARIN	109	BOLINAS/SN GERON	5671	5671	5671	0	0.0	1992	1992	1992	0	0.0
	110	NOVATO	28995	28289	28289	0	0.0	38393	38393	38393	0	0.0
	111	SAN RAFAEL/LUCAS	33116	33116	33116	0	0.0	56285	54626	54816	-190	-0.3
	112	ROSS/S ANSLMO/FA	13296	13296	13296	0	0.0	9433	9433	9433	0	0.0
	113	CORTE MADERA/LAR	11838	11838	11838	0	0.0	16429	16429	16429	0	0.0
MARIN	114	SAUSALITO/MV/TIB	25290	25290	25290	0	0.0	16043	14997	14807	190	1.3

Comparing POLIS 2010 allocations WITH and WITHOUT Highway Development
This scenario DOES NOT INCLUDE LAND AVAILABILITY CONSTRAINTS (Test 2)

COUNTY	ZONE		Maximum Allowed Local Land Use Potential (Household)	Household Allocations WITH HWY Development Policies	Household Allocations WITHOUT HWY Development Policies	Absolute Diff	Percent Diff	Maximum Allowed Local Land Use Potential (Employment)	Employment Allocations WITH HWY Development Policies	Employment Allocations WITHOUT HWY Development Policies	Absolute Diff	Percent Diff
SAN	1	SF-RICHMOND	--	33934	33934	0	0.0	--	38443	40506	-2063	-5.1
FRANCISCO	2	SF-MARINA	--	24250	24250	0	0.0	--	28857	29517	-660	-2.2
	3	SF-NORTHEAST	--	36112	36112	0	0.0	--	84999	84999	0	0.0
	4	SF-DOWNTOWN	--	30115	30115	0	0.0	--	245360	245360	0	0.0
	5	SF-WESTERN ADDIT	--	25210	25210	0	0.0	--	40184	35618	4566	12.8
	6	SF-BUENA VISTA	--	22023	22023	0	0.0	--	27562	27562	0	0.0
	7	SF-CENTRAL	--	20036	20036	0	0.0	--	8912	8761	151	1.7
	8	SF-MISSION	--	20803	20803	0	0.0	--	41764	44042	-2278	-5.2
	9	SF-SOUTH OF MARK	--	16292	16292	0	0.0	--	60423	60423	0	0.0
	10	SF-SOUTH BAYSHOR	--	15138	15138	0	0.0	--	31856	31614	242	0.8
	11	SF-BERNAL HEIGHT	--	15294	15294	0	0.0	--	12751	12596	155	1.2
	12	SF-SOUTH CENTRAL	--	23151	23151	0	0.0	--	12401	12401	0	0.0
	13	SF-INGLESIDE	--	20014	20014	0	0.0	--	20247	20247	0	0.0
SAN	14	SF-INNER SUN SET	--	21415	21415	0	0.0	--	24580	24698	-118	-0.5
FRANCISCO	15	SF-OUTER SUN SET	--	25313	25313	0	0.0	--	14540	14540	0	0.0
SAN	16	DALY CITY/BRISBA	--	33897	33897	0	0.0	--	40419	40426	-7	-0.0
MATEO	17	SOUTH SAN FRANCI	--	25278	25278	0	0.0	--	47905	48193	-288	-0.6
	18	SAN BRUNO	--	20290	20290	0	0.0	--	23848	24295	-447	-1.8
	19	PACIFICA/HALF MN	--	20576	20576	0	0.0	--	15429	15360	69	0.4
	20	MILLBRAE/BURLING	--	31778	27026	4752	17.6	--	49012	49012	0	0.0
	21	SAN MATEO	--	33396	33396	0	0.0	--	47339	45615	1724	3.8
	22	BELMONT/SAN CARL	--	22256	22256	0	0.0	--	35582	36648	-1066	-2.9
	23	FOSTER CITY	--	14397	14397	0	0.0	--	35300	34939	361	1.0
	24	REDWOOD CITY/ATH	--	33515	33515	0	0.0	--	46628	48227	-1599	-3.3
SAN	25	MENLO PK/E PALO	--	21843	21843	0	0.0	--	36917	35689	1228	3.4
MATEO	26	PORTOLA VLLY/WOO	--	18274	23026	-4752	-20.6	--	5251	5228	23	0.4
SANTA	27	PALO ALTO	--	25413	25413	0	0.0	--	79522	79522	0	0.0
CLARA	28	L ALTOS/L ALTOS	--	20550	20550	0	0.0	--	27453	27065	388	1.4
	29	MOUNTAIN VIEW	--	25246	25246	0	0.0	--	67862	67864	-2	-0.0
	30	CUPERTINO	--	20099	20099	0	0.0	--	65155	60846	4309	7.1
	31	SUNNYVALE-SOUTH	--	27046	27046	0	0.0	--	21258	21069	189	0.9
	32	SUNNYVALE-NORTH	--	23828	23828	0	0.0	--	80694	79655	1039	1.3

COUNTY	ZONE		Maximum Allowed Local Land Use Potential (Household)	Household Allocations WITH HWY Development Policies	Household Allocations WITHOUT HWY Development Policies	Absolute Diff	Percent Diff	Maximum Allowed Local Land Use Potential (Employment)	Employment Allocations WITH HWY Development Policies	Employment Allocations WITHOUT HWY Development Policies	Absolute Diff	Percent Diff
	33	SANTA CLARA	--	36444	36444	0	0.0	--	116841	116841	0	0.0
	34	SJ-WEST VALLY	--	24919	24919	0	0.0	--	27600	27268	332	1.2
	35	CAMPBELL	--	24122	24122	0	0.0	--	45714	45330	384	0.8
	36	LOST GATOS-SARAT	--	29119	29119	0	0.0	--	30717	30557	160	0.5
	37	SJ-CAMBRIAN (PAR	--	17117	17117	0	0.0	--	21172	20933	239	1.1
	38	SJ-WILLOW GLEN	--	27119	27119	0	0.0	--	24311	24311	0	0.0
	39	SJ-CENTRAL	--	30445	30445	0	0.0	--	84343	85381	-1038	-1.2
	40	MILPITAS WEST	--	47573	51072	-3499	-6.9	--	65622	65622	0	0.0
	41	MILPITAS EAST	--	11767	11767	0	0.0	--	7335	7206	129	1.8
	42	NORTH SJ AIRPORT	--	36081	39137	-3056	-7.8	--	89300	87025	2275	2.6
	43	SJ-BERRYESSA	--	17341	17341	0	0.0	--	44213	44182	31	0.1
	44	ALUM ROCK-WEST	--	14007	14007	0	0.0	--	14836	14639	197	1.3
	45	ALUM ROCK-EAST	--	17718	17718	0	0.0	--	12289	12115	174	1.4
	46	SJ-EVERGREEN	--	22039	22039	0	0.0	--	30153	30201	-48	-0.2
	47	SJ-SOUTH	--	24899	24899	0	0.0	--	34708	34616	92	0.3
	48	SJ-EDENVALE-NORT	--	21057	21057	0	0.0	--	15237	14979	258	1.7
	49	SJ-EDENVALE SOUT	--	18668	18668	0	0.0	--	67785	70313	-2528	-3.6
	50	SJ-ALMADEN	--	14580	14580	0	0.0	--	9747	9747	0	0.0
SANTA	51	MORGAN HILL	--	17317	14261	3056	21.4	--	49177	49177	0	0.0
CLARA	52	GILROY	--	30386	26887	3499	13.0	--	32362	38950	-6588	-16.9
ALAMEDA	53	ALBANY,S. BERKEL	--	27182	27182	0	0.0	--	34280	31307	2973	9.5
	54	BERKELEY HILLS-U	--	26831	26831	0	0.0	--	44804	44804	0	0.0
	55	N OAKLAND/EMERYV	--	20587	20587	0	0.0	--	30214	28277	1937	6.9
	56	WEST OAKLAND	--	26925	26925	0	0.0	--	98857	98857	0	0.0
	57	ALAMEDA-NORTH	--	8968	8968	0	0.0	--	25827	26241	-414	-1.6
	58	ALAMEDA-SOUTHSHO	--	16638	16638	0	0.0	--	20141	19824	317	1.6
	59	HARBOR BAY ISLE	--	25747	26393	-646	-2.4	--	14661	14606	55	0.4
	60	OAKLAND-FRUITVAL	--	20841	20841	0	0.0	--	22315	21570	745	3.5
	61	OAKLAND-580 FOOT	--	59065	58686	379	0.6	--	19454	17495	1959	11.2
	62	OAK-MONTCLAIR/PI	--	15867	15867	0	0.0	--	11564	11647	-83	-0.7
	63	OAKLAND SEMINARY	--	20956	20956	0	0.0	--	20849	19865	984	5.0
	64	OKLAND AIRPORT-C	--	24681	45395	-20714	-45.6	--	30194	27424	2770	10.1
	65	E OAKLAND/GOLF L	--	19290	19290	0	0.0	--	17318	17065	253	1.5
	66	SAN LEANDRO	--	29623	29623	0	0.0	--	44500	45953	-1453	-3.2
	67	SAN LORENZO/ASHL	--	16992	16992	0	0.0	--	19018	19018	0	0.0
	68	CASTRO VALLEY	--	21004	21004	0	0.0	--	17189	17189	0	0.0
	69	HAYWARD-EAST	--	21471	21471	0	0.0	--	18473	18275	198	1.1

COUNTY	ZONE		Maximum Allowed Local Land Use Potential (Household)	Household Allocations WITH HWY Development Policies	Household Allocations WITHOUT HWY Development Policies	Absolute Diff	Percent Diff	Maximum Allowed Local Land Use Potential (Employment)	Employment Allocations WITH HWY Development Policies	Employment Allocations WITHOUT HWY Development Policies	Absolute Diff	Percent Diff
	70	HAYWARD-WEST	--	24553	24553	0	0.0	--	59623	59623	0	0.0
	71	UNION CITY EAST	--	28783	7423	21360	287.8	--	10480	10480	0	0.0
	72	UNION CITY WEST	--	8206	8206	0	0.0	--	12606	12606	0	0.0
	73	FREMONT BAYLANDS	--	46328	32279	14049	43.5	--	37711	35415	2296	6.5
	74	NEWARK	--	12330	12330	0	0.0	--	21524	26233	-4709	-18.0
	75	FREMONT CENTRAL	--	27038	27038	0	0.0	--	25777	25751	26	0.1
	76	FREMONT-NORTH,EA	--	30624	30624	0	0.0	--	26724	28653	-1929	-6.7
	77	DUBLIN	--	7631	21680	-14049	-64.8	--	27503	27010	493	1.8
	78	PLEASANTON	--	19233	19233	0	0.0	--	47463	51560	-4097	-7.9
ALAMEDA	79	LIVERMORE	--	21450	21450	0	0.0	--	48412	49039	-627	-1.3
CONTRA	80	SAN PABLO	--	49739	34595	15144	43.8	--	17137	15584	1553	10.0
COSTA	81	RICHMOND	--	30651	30651	0	0.0	--	32973	32973	0	0.0
	82	EL CERRITO	--	34195	34195	0	0.0	--	13144	13144	0	0.0
	83	PINOLE	--	20592	20592	0	0.0	--	18410	18523	-113	-0.6
	84	MARTINEZ	--	27878	27878	0	0.0	--	22588	22876	-288	-1.3
	85	CONCORD-WEST	--	20493	20493	0	0.0	--	48134	48000	134	0.3
	86	CONCORD/CLAYTON	--	24263	24263	0	0.0	--	22015	22015	0	0.0
	87	WALNUT CREEK	--	34776	49920	-15144	-30.3	--	45815	45815	0	0.0
	88	PLEASANT HILL/WC	--	29437	29437	0	0.0	--	33924	33583	341	1.0
	89	LAF/MORAGA/ORIND	--	19836	19836	0	0.0	--	21103	19705	1398	7.1
	90	ALAMO-DANVILLE-S	--	21730	21730	0	0.0	--	16579	17907	-1328	-7.4
	91	SAN RAMON VALLEY	--	30062	30062	0	0.0	--	29762	31671	-1909	-6.0
	92	PITTSBURG	--	21544	21544	0	0.0	--	24661	24405	256	1.0
CONTRA	93	ANTIOCH	--	21962	21962	0	0.0	--	26655	26845	-190	-0.7
COSTA	94	BRENTWOOD	--	11642	11642	0	0.0	--	20806	20660	146	0.7
SOLANO	95	VACAVILLE/DIXON	--	27847	27847	0	0.0	--	31237	31200	37	0.1
	96	FAIRFIELD SUISUN	--	33254	33254	0	0.0	--	50827	54622	-3795	-6.9
	97	RIO VISTA	--	43292	49597	-6305	-12.7	--	49709	45950	3759	8.2
	98	BENICIA	--	29511	23206	6305	27.2	--	13672	13672	0	0.0
SOLANO	99	VALLEJO	--	37996	37996	0	0.0	--	44245	44245	0	0.0
NAPA	100	NAPA CITY	--	36687	39267	-2580	-6.6	--	54621	53134	1487	2.8
NAPA	101	CALISTOGA/YOUNT/	--	18413	15833	2580	16.3	--	12644	14131	-1487	-10.5
SONOMA	102	NORTHERN SONOMA	--	23478	23478	0	0.0	--	28436	27263	1173	4.3
	103	SEBASTOPOL	--	29297	22394	6903	30.8	--	13889	13890	-1	-0.0

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	104	SANTA ROSA-WEST	--	27956	27956	0	0.0	--	49718	55647	-5929	-10.7
	105	SANTA ROSA-EAST	--	48959	61119	-12160	-19.9	--	55559	52805	2754	5.2
	106	ROHNERT PARK/COT	--	19937	19937	0	0.0	--	30205	30851	-646	-2.1
	107	PETALUMA	--	35191	29934	5257	17.6	--	22963	20312	2651	13.1
SONOMA	108	SONOMA	--	25682	25682	0	0.0	--	11015	11018	-3	-0.0
MARIN	109	BOLINAS/SN GERON	--	4334	4334	0	0.0	--	3670	3757	-87	-2.3
	110	NOVATO	--	21029	21029	0	0.0	--	37624	40802	-3178	-7.8
	111	SAN RAFAEL/LUCAS	--	26183	26183	0	0.0	--	48297	47019	1278	2.7
	112	ROSS/S ANSLMO/FA	--	18711	16423	2288	13.9	--	13827	13917	-90	-0.6
	113	CORTE MADERA/LAR	--	23933	22381	1552	6.9	--	18370	16294	2076	12.7
MARIN	114	SAUSALITO/MV/TIB	--	23310	27150	-3840	-14.1	--	14082	14082	0	0.0